Revolutionising mobile networks with SDN and NFV

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Networks are getting ‘messy’

Today’s network architectures were meant for ‘vertical’ Telcos
The industry direction makes them complex, costly and inflexible
**Widening the cost-revenue gap even further**
What is making networks complex?

Lots of detailed configuration, across the network and protocol layers
New functions often mean new, dedicated appliances and new vendors
Vendors have different ideas on management, redundancy, capacity...
Overlapping generations of technology, parallel networks mergers
Hard to define the clear interfaces, accountabilities and process

Operators have responded by getting better at managing complexity
SDN and NFV use IT Datacentre techniques to make networks simpler
Software Defined Networks (SDN)

- Originated in the data centre
- Separation and centralisation of the control plane
- Abstractions and open APIs put the network under programmed control
- Decouples services from the underlying physical network
- Enables completely new ways of building services and architecting networks

Network applications with a global view

Open API presents abstract, global network view

SDN Controller

Open methods for configuring packet forwarding

Control plane

User plane

Flow table

Routing

Traffic Engineering

Security Policy

Load balancing

Flow table

Flow table

Flow table

Routing

Traffic Engineering

Security Policy

Load balancing

Flow table

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Flow table
Network Functions Virtualisation

- Originated with Telcos, being normalised by ETSI
- Focus on decoupling logical functions from the physical implementation
- About cost-effectiveness, efficient utilisation, ease of deployment, scaling

Supports Virtual Network Functions (VNFs) - logical equivalents of physical appliances

simple, scalable, uniform physical infrastructure on commodity server and switch hardware

virtual architecture is distributed across the physical infrastructure
Combining SDN and NFV

- Both leverage cloud and DC IT concepts
- Both open up the network hardware market to commoditisation
- Both open up the network equipment market to new players
- Use SDN to automate a complex virtualised network
**Incremental benefits**

Benefits accrue gradually in proportion to degree of SDN/NFV

**Hardware TCO**
- Commoditised hardware
- Less hardware overall
- Fewer types of hardware
- Less power, space etc
- Fewer skill sets

**Simplicity**
- Deployment, SON
- Capacity planning
- Hiding of complex details
- Automation

**Flexibility and agility**
- New sources for network applications
- New models and process for testing
- New functions can be deployed quickly
- ‘Darwinian’ service development

**Robustness and Efficiency**
- Segregation on common infrastructure
- Elastic capacity, ‘cloudbursting’
- Resource orchestration
- Failover
Emergent capabilities
At a critical mass of SDN/NFV, really new things become possible

**Meta-policy**
Define and apply high-level, global policies for things like security, load distribution, resource allocation and apply them to the entire network quickly and consistently without needing to know the details of how they are implemented.

**Pervasive monitoring**
Pick off all the traffic or just individual flows from anywhere in the network on demand, store it for ‘Big Data’ applications or forensic analysis of network events.

**Network as a Service**
Expose the underlying resources and capabilities of the end-to-end network to direct, dynamic control by 3rd parties, within a policy and security envelope.

**New business models**
SDN/NFV-based Infrastructure/Network-/Platform-as-a-Service as the basis for clear accountabilities and process between all the entities involved in Think-Build-Run of the end-to-end network.
Mobile challenges

- Huge growth in traffic and devices
- Dealing with ‘over-the-top’ services
- Complex Value Added Services
- Diverse devices and services
- Fragmented subscriber identities
- Diverse access, backhaul, transport
- Stability, security, command and control
- Monetising Big Data
## Evolution themes and impact on mobile

<table>
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<tr>
<th>Theme</th>
<th>Trend</th>
<th>Mobile core impact</th>
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<tr>
<td>Traffic evolution</td>
<td>Massive growth in traffic (~100x)</td>
<td>Decentralise the core, <strong>scale out</strong> user plane capacity to the <strong>Cloud</strong></td>
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<td>Streaming video dominates</td>
<td><strong>Cooperation with content providers</strong> for best QoE</td>
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<td>Encryption and an opaque Internet</td>
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<td>Service evolution</td>
<td>Traditional services (voice, text) mainly OTT</td>
<td><strong>Smart core</strong> capabilities exposed <strong>agnostically to ‘Servcos’</strong></td>
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<td>Huge numbers of IoT devices</td>
<td><strong>Decentralise</strong> the core, <strong>Scale out</strong> connection capacity to the <strong>Cloud</strong></td>
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<td>Device, connection &amp; service diversity</td>
<td><strong>Multiple</strong> virtual cores on <strong>single physical infrastructure</strong></td>
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<td>Identity</td>
<td>Subscribers value Internet Platform identity</td>
<td><strong>Integrate Internet identities</strong> with EE services</td>
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<td>Transport evolution</td>
<td>Diversifying providers and types backhaul</td>
<td><strong>Seamlessly and agnostically</strong> integrate diverse backhaul solutions</td>
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<td>Radical changes in core transport</td>
<td><strong>Decouple</strong> mobile core from <strong>core transport</strong></td>
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<td>Backhaul services include compute IaaS</td>
<td><strong>Backhaul IaaS</strong> used for virtualised, decentralised mobile core</td>
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<td>Access evolution</td>
<td>Cloud RAN, LTE centralisation</td>
<td>Centralising <strong>LTE control</strong> merges with decentralised mobile core</td>
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<td>Multilayer RAN</td>
<td><strong>Decentralise</strong> mobile core mobility functions</td>
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<td>Heterogeneous access (small cells, wifi)</td>
<td><strong>Best network</strong> selection based on user, location, application, load</td>
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<td><strong>Seamlessly and agnostically</strong> integrate diverse access types</td>
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<td>Big Data</td>
<td>Pervasive real-time network intelligence</td>
<td>Heuristic <strong>network optimisation</strong> for QoE, yield etc. (SDN)</td>
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<td>Increasing value of information about traffic</td>
<td>Core architected to <strong>capture data about traffic</strong></td>
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<td>New network models</td>
<td>Network Function Virtualisation (NFV)</td>
<td><strong>Virtual core(s)</strong> on <strong>commodity infrastructure</strong> (Self-build or IaaS)</td>
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<td>Software Defined Networks (SDN)</td>
<td><strong>Rapid service development</strong>, network <strong>automation</strong></td>
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<td>Backhaul and core transport services via <strong>SDN NaaS</strong></td>
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A future mobile network

Increasingly complex, unpredictable and correlated device behaviour

Broadening ranges of devices, access types, backhaul technologies and providers

Big Data & analytics

Pervasive data capture

Exposé smart capabilities in a Servco agnostic way

Access and backhaul agnostic mobile core infrastructure

Decentralisation of some core functions into the backhaul domain

EE

MVNO

Content

B2B

Broadening range of ‘Servco’ models

Maintain a single core infrastructure for widening range of devices and services

Core Transport

Backhaul Transport

Connected Cars

Emergency Services

Video streaming

Voice & video calling

Telemetry

Connected

Fibre

Ethernet

VPN

BT

Virgin

3G

4G

Small cell

Femto

Trusted wifi

Public wifi

B2B

2G

Emergency Services

Video streaming

Voice & video calling

Telemetry

2G

3G

4G

Small cell

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Mobile future with NFV and SDN

Increasingly complex, unpredictable and correlated device behaviour

Broadening ranges of devices, access types, backhaul technologies and providers

- Smartphone
- Tablets
- M2M
- Internet of Things
- 2G
- 3G
- 4G
- Small cell
- Femto
- Smartphone
- Fibre
- Ethernet
- VPN
- BT
- Trusted wifi
- Public wifi
- 4G
- 3G
- 2G
- Smartcore
- SDN
- NFV
- Compute IaaS
- Transport NaaS
- Core Transport
- Cloud

Big Data Service
- EE
- MVNO
- Content
- B2B

Broadening range of ‘Servco’ models

Network control & automation, meta-policies

Multiple NFV-based virtual mobile ‘Smartcores’ tailored to access, devices, services and servcos on common infrastructure, built on multi-tenant ‘infrastructure as a service’
Timeline

Exploratory phase

- 2014: SDN/NFV is standard aspect of procurement
- 2015: Intensify use of existing initiatives (cloudbursting, use of COTs, virtualisation)
- 2016: Virtualised test environments
- 2017: Exploit SDN/NFV for small cell
- 2018: Parallel/segregated core networks for special or critical services
- 2019: Primary core migration
- 2020: SDN/NFV predominates

Evolutionary phase

- 2015: Most systems obtainable in virtualised form
- 2016: New suppliers and ecosystems
- 2017: New commercial models

Revolutionary phase

- 2019: Emergent network capabilities, new network architectures
Caveats and expectations

Caveats

• Geography and physics still matter
• **Control** of functions is key
• Beware exchanging one kind of complexity for another
• **Orchestration** will be a key capability
• Likely skills gap in the short term
• Big effort to validate and integrate many functions from different sources, select hardware platform, software environment etc.

Expectations

• Expect new commercial and support models
• Expect new industry players and ecosystems
• Expect ‘NFV optimised’ commodity hardware
• Transport will retain a separate architecture from other network functions
• Likely emergence of competing E2E solutions around key NFV technologies like orchestration and platforms
Thanks